

SEP. 17. 2001 5:13PM MB&F LLC 401 N MICH

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DATE: September 17, 2001

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RE: Lakeshore East

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CLIENT MATTER NUMBER:	139497/9298

NOTES/COMMENTS:

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SURVEY ACTIVITIES
AT 221 NORTH COLUMBUS DRIVE
CHICAGO, ILLINOIS
PERFORMED ON
JULY 27 AND, JULY 30 - AUGUST 1, 2001

FOR

DAI ENVIRONMENTAL
POLO PARK BUSINESS CENTER
27834 NORTH IRMA LEE CIRCLE
LAKE FOREST, IL 60045-5130

BY

RSS/
6312 W. OAKTON STREET
MORTON GROVE, ILLINOIS 60053-2723

AUGUST 22, 2001

CONFIDENTIAL**I. INTRODUCTION**

During the early 20th century, radioactive material was used in industrial operations in the Streeterville area of Chicago, between Illinois Street and Grand Avenue east of Michigan Avenue. The US Environmental Protection Agency (EPA) reported that material from these operations may have been in fill used on the subject site at 221 North Columbus Drive, Chicago, Illinois. The EPA has an action level in this area of 5 pCi/g of Ra-226 plus Ra-228 above background concentration. Background concentrations are assumed to be 2.1 pCi/g total for an actual level of 7.1 pCi/g.

II. METHODOLOGY**Surface radiation level survey**

On July 27 and July 30, RSSI performed a walkover survey at 221 North Columbus Drive. Above-ground radiation levels were measured by passing a side shielded 2 inch by 2 inch thallium doped sodium iodide (NaI(Tl)) detector over an approximate 2.5 meter grid on the survey area. The detectors were positioned about 3 inches from the ground surface during the survey and were connected to Ludlum ratemeters, serial numbers 149064 and 149080. Areas with count rates above twice background were marked and identified, and their appropriate locations recorded.

Down-hole Measurements

In selected areas with elevated radiation levels and at other selected areas, down-hole radiation levels were measured and gamma spectroscopy analyses were performed. Down-hole measurements were performed at eleven locations selected by DAI in the vicinity of elevated surface radiation levels. All measurements were performed using a Ludlum Model 2200 ratemeter-scaler, serial number 36762, equipped with a 2" x 2" NaI(Tl) probe on July 30 - August 1, 2001.

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Soil Analysis

A total of 25 soil samples were collected from bore-holes in 500 ml Marinelli beakers. Samples were counted for 1 hour on a high-resolution gamma spectroscopy system.

The samples were analyzed for the uranium, thorium and actinium series and potassium-40 using GDR software. Radium 228 is in the thorium series and emits no significant photons. Radium 226 is in the uranium series and has only one significant photon at 186 keV whose abundance is 0.03 photons per disintegration. These properties make direct identification and quantification of these isotopes of radium difficult.

The concentrations of surrogates with more abundant high energy photons usually represent the concentration of Ra-228 and Ra-226. Actinium-228, in the thorium series, is frequently used as a surrogate for Radium-228, and Lead-214, in the uranium series, is frequently used as a surrogate for Radium-226. These surrogates are in equilibrium with the radium isotopes after one month in-situ.

III. RESULTS

Surface radiation level survey results

The background radiation level with the Ludlum 193 and the 2-inch by 2-inch sodium iodide detector was 2,000 counts per minute (cpm). Nineteen areas on the site had radiation levels at or above twice the background reading. The most elevated readings were found in the southeast corner of the driving range, but contamination was also found on and around the #2 tee box and in the #2 fairway. Walkover results and locations of elevated areas are in Appendix A.

Down-hole Results

Down-hole measurement results are in Appendix B. Bore-hole B9 readings could not be made deeper than 18 inches because of an irrigation sprinkler line.

The highest reading was 414,029 cpm in the bore-hole B1 at a depth of 1 ft. Except for bore-hole B4, it appeared that any contamination present was in the top layer of soil. The highest

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reading in bore-hole B4 was at a depth of 7 ft. In hole B5 a small amount of greyish-white material, resembling thorium tailings found on other sites associated with the Streeterville operation, was observed

Soil Analysis Results

The high-resolution gamma spectroscopy analysis results are in Appendix C. The highest concentration of Ac-228 plus Pb-214 was 389 pCi/g in a sample collected from bore-hole B1. The sample was collected from a depth of approximately 0 ft-1 ft. This concentration represents the sum of concentrations of Ra-228 and Ra-226.

Several parameters are set in the GDR software before analysis. Sensitivity discriminates against statistically poor peaks. The lower the search sensitivity, the smaller and less defined the peak can be and still be recognized. The range for sensitivity is from 0 to 10. The manufacturer's default value of 2 was used. Low energy cutoff sets the value below which energies will not be considered in the peak search routine. The low energy cutoff was set to 35 keV. The library window is the tolerance in keV used to determine if a peak energy is a close enough match to a library energy to identify the peak for activity reporting. The library window tolerance was set to 2.5 keV. The final parameter is the gamma fraction limit (%). This value, ranging from 0 to 100, sets the specified fraction of known secondary peaks that must be present in the spectrum. The gamma fraction limit was set to 10%. The efficiency and library files used in the analysis are in Appendix D.

IV. CONCLUSIONS

The results of the surface survey show evidence of concentrations of radioactivity above normal background levels at a number of locations. Down-hole measurements in these areas are significantly elevated above levels usually attributed to naturally occurring radioactive material or rubble in the soil.

In locations with elevated radiation levels, soil samples contained concentrations of radionuclides in the thorium series above normal background and similar to concentrations in sites in the Streeterville Area suspected to be contaminated with

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thorium residuals. Uranium series radionuclides were also elevated and within the range observed in soils on the Streeterville sites. The Gamma spectroscopy results indicate contamination does not appear to extend below several feet in depth.

The EPA has applied an action level in the Streeterville area of a total of 7.1 pCi/g Ra-226 plus Ra-228. Seven samples out of 25 samples had concentrations of radium-226 and radium-228 surrogates in excess of the EPA's action level of 7.1 pCi/g.

CONFIDENTIAL**APPENDIX A****Walkover Results and Site Plan**

Location #	Corresponding Bore-Hole #	CPM
1	B1	230,000
2	B2	9,000
3	B3	7,000
4	B4	9,500
5	B5	12,500
6	N/A	6,000
7	N/A	4,000
8	N/A	5,000
9	N/A	5,000
10	B9, B9R	40,000
11	N/A	32,000
12	N/A	14,000
13	N/A	23,000
14	N/A	140,000
15	N/A	6,000
16	N/A	10,000
17	N/A	4,000
18	N/A	20,000
19	N/A	3,500

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APPENDIX B

Down Hole Results Recorded July 30 - August 1, 2001

Depth (ft)	Location										
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B9R	B10
1	414029	40067	56567	16733	27267	20870	72836	27532	234404	30565	24077
2	53749	24732	26108	11827	13220	16804	23280	24875	-	23813	20562
3	51080	27706	17499	10382	12415	13654	19283	20188	-	23662	19398
4	45002	26710	18549	11636	15231	14519	19168	19188	-	16518	20177
5	-	20065	17300	14147	11816	15275	29111	13898	-	16165	21350
6	-	14177	16837	19683	15168	16530	31933	14460	-	18907	21288
7	-	12815	16441	21323	13111	17826	32567	15469	-	19314	19913
8	-	13840	15862	17185	14055	19847	24530	17817	-	17896	21014
9	-	12723	14827	-	14819	16686	23702	17945	-	21175	20670
10	-	14412	14047	-	14318	-	-	-	-	22035	22502
11	-	17019	13678	-	13581	-	-	-	-	-	17218
12	-	16005	14259	-	10367	-	-	-	-	-	17201
13	-	16667	15442	-	8578	-	-	-	-	-	-
14	-	15445	15851	-	-	-	-	-	-	-	-
15	-	-	16520	-	-	-	-	-	-	-	-
16	-	-	16110	-	-	-	-	-	-	-	-

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APPENDIX C

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Gamma Spectroscopy Results

Sample NO.	Borehole ID	Depth ft	Ac-228 pCi/g	Pb-214 pCi/g	TOTAL pCi/g
012624	B1	0-1	3.02E+02	8.73E+01	3.89E+02
012650	B1	4-6	2.48E+00	1.08E+00	3.56E+00
012651	B2	0-1	6.08E+00	1.66E+00	7.74E+00
012652	B2	3-4	8.96E-01	4.23E+00	5.13E+00
012653	B3	0-1	2.94E+00	1.49E+00	4.43E+00
012654	B3	1-2	5.34E+00	1.96E+00	7.30E+00
012686	B3	4-6	8.18E-01	8.71E-01	1.69E+00
012687	B4	5-7	4.84E-01	7.52E-01	1.24E+00
012655	B5	0-1	2.55E+01	4.90E+00	3.04E+01
012656	B5	8-10	3.64E-01	5.86E-01	9.50E-01
012688	B6	0-1	1.49E+00	1.37E+00	2.86E+00
012689	B6	1-2	7.32E-01	1.13E+00	1.86E+00
012690	B7	0-1	1.09E+01	3.56E+00	1.45E+01
012691	B7	5-7	7.79E-01	8.71E-01	1.65E+00
012692	B8	0-1	3.25E+00	1.63E+00	4.88E+00
012693	B9R	0-1	9.53E+00	2.47E+00	1.20E+01
012694	B9	0-2	1.55E+01	2.45E+00	1.80E+01
012695	B10	0-1	3.55E+00	1.66E+00	5.21E+00
012793	B11	0-1	0.00E+00	1.62E+00	1.62E+00
012792	B13	0-1	0.00E+00	1.06E+00	1.06E+00
012798	B14	0-1	0.00E+00	7.66E-01	7.66E-01
012795	B16	0-1	0.00E+00	7.66E-01	7.66E-01
012796	B18	0-2	0.00E+00	7.56E-01	7.56E-01
012794	B18	2-4	0.00E+00	5.57E-01	5.57E-01
012797	B18	6-8	0.00E+00	3.24E-01	3.24E-01

* Bolded Values exceed 7.1 pCi/g

APPENDIX D

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Efficiency and Library Files Used in Gamma Spec Analysis

EFFICIENCY FILE: h:\gdr\eff\500mar.eff
 ID.: 500 ml Marinelli

$$\text{Eff.} = 1 / [7.31e-002 * \text{En}^{-2.40e+000} + 7.89e+001 * \text{En}^{8.95e-001}]$$

(Where En = Energy in MeV)

Library file: h:\gdr\lib\UThAcK.lib
 ID.: U, Th, & Ac Natural Series + K

Pk. #	Energy (keV)	Isotope Name	2ndary Pk #	Gamma Type	Gamma Fraction	Halflife	DAC (uCi/ml)	Calc Cntr	Sbtr Cntr
1	11.70	Ra-223	19	I.D.	0.2474	1.1434e+001 D	3.0e-010	Y	Y
2	12.30	Fr-223	7	I.D.	0.3368	2.1800e+001 M	3.0e-007	Y	Y
3	13.00	U-235	25	I.D.	0.3910	7.0380e+008 Y	2.0e-011	Y	Y
4	27.36	Pa-231	26	QUANT	0.0930	3.2760e+004 Y	6.0e-013	Y	Y
5	46.50	Pb-210	0	QUANT	0.0405	2.2260e+001 Y	1.0e-010	Y	Y
6	50.10	Th-227	48	QUANT	0.0840	1.8718e+001 D	1.0e-010	Y	Y
7	50.10	Fr-223	18	QUANT	0.3170	2.1800e+001 M	3.0e-007	Y	Y
8	53.20	U-234	0	QUANT	0.0012	2.4450e+005 Y	2.0e-011	Y	Y
9	59.00	Th-232	35	QUANT	0.0019	1.4050e+010 Y	5.0e-013	Y	Y
10	63.29	Th-234	27	QUANT	0.0381	2.4100e+001 D	6.0e-008	Y	Y
11	66.38	U-238	0	QUANT	0.0010	4.4680e+009 Y	2.0e-011	Y	Y
12	67.67	Th-230	0	QUANT	0.0037	7.7000e+004 Y	3.0e-012	Y	Y
13	74.82	Pb-212	17	QUANT	0.1069	1.0643e+001 H	1.0e-008	Y	Y
14	74.82	Pb-214	16	QUANT	0.0621	2.6800e+001 M	3.0e-007	Y	Y
15	74.97	Tl-208	56	QUANT	0.0343	3.0530e+000 M	0.0e+000	Y	Y
16	77.11	Pb-214	23	QUANT	0.1046	2.6800e+001 M	3.0e-007	Y	Y
17	77.11	Pb-212	22	QUANT	0.1800	1.0643e+001 H	1.0e-008	Y	Y
18	79.80	Fr-223	24	QUANT	0.0761	2.1800e+001 M	3.0e-007	Y	Y
19	83.78	Ra-223	31	QUANT	0.2470	1.1434e+001 D	3.0e-010	Y	Y
20	84.21	Th-231	0	QUANT	0.0644	2.5520e+001 H	3.0e-006	Y	Y
21	84.37	Th-228	46	QUANT	0.0121	1.9132e+000 Y	4.0e-012	Y	Y
22	87.30	Pb-212	49	QUANT	0.0804	1.0643e+001 H	1.0e-008	Y	Y
23	87.30	Pb-214	51	QUANT	0.0467	2.6800e+001 M	3.0e-007	Y	Y
24	88.47	Fr-223	47	QUANT	0.0242	2.1800e+001 M	3.0e-007	Y	Y
25	89.95	U-235	29	QUANT	0.0273	7.0380e+008 Y	2.0e-011	Y	Y
26	90.88	Pa-231	41	QUANT	0.0102	3.2760e+004 Y	6.0e-013	Y	Y
27	92.38	Th-234	28	QUANT	0.0272	2.4100e+001 D	6.0e-008	Y	Y
28	92.80	Th-234	10	QUANT	0.0269	2.4100e+001 D	6.0e-008	Y	Y
29	93.35	U-235	37	QUANT	0.0446	7.0380e+008 Y	2.0e-011	Y	Y
30	94.66	Pa-234	32	QUANT	0.1570	6.7000e+000 H	3.0e-006	Y	Y
31	94.90	Ra-223	38	QUANT	0.1120	1.1434e+001 D	3.0e-010	Y	Y
32	98.44	Pa-234	33	QUANT	0.2544	6.7000e+000 H	3.0e-006	Y	Y
33	111.00	Pa-234	36	QUANT	0.1185	6.7000e+000 H	3.0e-006	Y	Y
34	115.35	Ac-227	0	QUANT	0.0010	2.1773e+001 Y	2.0e-013	Y	Y
35	125.00	Th-232	9	QUANT	0.0004	1.4050e+010 Y	5.0e-013	Y	Y

APPENDIX D (continued)

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36	131.20	Pa-234	55	QUANT	0.2040	6.7000e+000	H	3.0e-006	Y	Y
37	143.76	U-235	40	QUANT	0.1050	7.0380e+008	Y	2.0e-011	Y	Y
38	144.24	Ra-223	39	QUANT	0.0324	1.1434e+001	D	3.0e-010	Y	Y
39	154.21	Ra-223	52	QUANT	0.0558	1.1434e+001	D	3.0e-010	Y	Y
40	163.36	U-235	42	QUANT	0.0407	7.0380e+008	Y	2.0e-011	Y	Y
41	165.52	Pa-231	59	QUANT	0.0143	3.2760e+004	Y	6.0e-013	Y	Y
42	185.72	U-235	44	QUANT	0.5400	7.0380e+008	Y	2.0e-011	Y	Y
43	186.21	Ra-226	0	I.D.	0.0328	1.6000e+003	Y	3.0e-010	Y	Y
44	205.31	U-235	3	QUANT	0.0470	7.0380e+008	Y	2.0e-011	Y	Y
45	209.28	Ac-228	53	QUANT	0.0443	6.1300e+000	H	4.0e-009	Y	Y
46	215.98	Th-228	21	QUANT	0.0024	1.9132e+000	Y	4.0e-012	Y	Y
47	234.90	Fr-223	2	QUANT	0.0282	2.1800e+001	M	3.0e-007	Y	Y
48	236.00	Th-227	6	QUANT	0.1150	1.8718e+001	D	1.0e-010	Y	Y
49	238.63	Pb-212	60	QUANT	0.4465	1.0643e+001	H	1.0e-008	Y	Y
50	240.98	Ra-224	0	QUANT	0.0395	3.6200e+000	D	7.0e-010	Y	Y
51	241.98	Pb-214	57	QUANT	0.0749	2.6800e+001	M	3.0e-007	Y	Y
52	269.46	Ra-223	62	QUANT	0.1360	1.1434e+001	D	3.0e-010	Y	Y
53	270.23	Ac-228	63	QUANT	0.0360	6.1300e+000	H	4.0e-009	Y	Y
54	271.23	Rn-219	69	QUANT	0.0106	3.9600e+000	S	0.0e+000	Y	Y
55	272.10	Pa-234	65	QUANT	0.0102	6.7000e+000	H	3.0e-006	Y	Y
56	277.35	Tl-208	75	QUANT	0.0679	3.0530e+000	M	0.0e+000	Y	Y
57	295.21	Pb-214	68	QUANT	0.1925	2.6800e+001	M	3.0e-007	Y	Y
58	298.00	Tl-210	86	QUANT	0.7917	1.3000e+000	M	0.0e+000	Y	Y
59	300.08	Pa-231	61	QUANT	0.0230	3.2760e+004	Y	6.0e-013	Y	Y
60	300.09	Pb-212	13	QUANT	0.0341	1.0643e+001	H	1.0e-008	Y	Y
61	302.67	Pa-231	4	QUANT	0.0230	3.2760e+004	Y	6.0e-013	Y	Y
62	323.87	Ra-223	1	QUANT	0.0388	1.1434e+001	D	3.0e-010	Y	Y
63	327.64	Ac-228	66	QUANT	0.0321	6.1300e+000	H	4.0e-009	Y	Y
64	327.96	Bi-212	81	QUANT	0.0013	6.0550e+001	M	1.0e-007	Y	Y
65	328.00	Pa-234	76	QUANT	0.0031	6.7000e+000	H	3.0e-006	Y	Y
66	338.32	Ac-228	71	QUANT	0.1136	6.1300e+000	H	4.0e-009	Y	Y
67	351.07	Bi-211	0	QUANT	0.1294	2.1300e+000	M	0.0e+000	Y	Y
68	351.92	Pb-214	14	QUANT	0.3721	2.6800e+001	M	3.0e-007	Y	Y
69	401.81	Rn-219	54	QUANT	0.0650	3.9600e+000	S	0.0e+000	Y	Y
70	404.84	Pb-211	72	QUANT	0.0294	3.6100e+001	M	3.0e-007	Y	Y
71	409.51	Ac-228	74	QUANT	0.0213	6.1300e+000	H	4.0e-009	Y	Y
72	427.08	Pb-211	89	QUANT	0.0132	3.6100e+001	M	3.0e-007	Y	Y
73	438.70	Po-215	0	QUANT	0.0003	7.7800e-004	S	0.0e+000	Y	Y
74	463.00	Ac-228	84	QUANT	0.0443	6.1300e+000	H	4.0e-009	Y	Y
75	510.84	Tl-208	78	QUANT	0.2156	3.0530e+000	M	0.0e+000	Y	Y
76	569.50	Pa-234	80	QUANT	0.1091	6.7000e+000	H	3.0e-006	Y	Y
77	569.67	Po-211	93	QUANT	0.0054	5.1600e-001	S	0.0e+000	Y	Y
78	583.14	Tl-208	90	QUANT	0.8423	3.0530e+000	M	0.0e+000	Y	Y
79	609.31	Bi-214	82	QUANT	0.4628	1.9900e+001	M	3.0e-007	Y	Y
80	660.60	Pa-234	83	QUANT	0.0031	6.7000e+000	H	3.0e-006	Y	Y
81	727.17	Bi-212	64	QUANT	0.1183	6.0550e+001	M	1.0e-007	Y	Y
82	768.36	Bi-214	98	QUANT	0.0504	1.9900e+001	M	3.0e-007	Y	Y
83	768.70	Pa-234	91	QUANT	0.0057	6.7000e+000	H	3.0e-006	Y	Y
84	794.70	Ac-228	95	QUANT	0.0463	6.1300e+000	H	4.0e-009	Y	Y
85	797.30	Po-214	0	QUANT	0.0001	6.3700e-005	S	0.0e+000	Y	Y
86	799.70	Tl-210	106	QUANT	0.9896	1.3000e+000	M	0.0e+000	Y	Y
87	803.10	Po-210	0	QUANT	0.0000	1.3838e+002	D	3.0e-010	Y	Y
88	804.90	Po-216	0	QUANT	0.0000	1.4600e-001	S	0.0e+000	Y	Y
89	831.96	Pb-211	70	QUANT	0.0286	3.6100e+001	M	3.0e-007	Y	Y
90	860.37	Tl-208	15	QUANT	0.1245	3.0530e+000	M	0.0e+000	Y	Y
91	880.51	Pa-234	92	QUANT	0.1224	6.7000e+000	H	3.0e-006	Y	Y

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92	883.24	Pa-234	96	QUANT	0.1224	6.7000e+000	H	3.0e-006	Y	Y
93	897.83	Po-211	77	QUANT	0.0052	5.1600e-001	S	0.0e+000	Y	Y
94	897.83	Tl-207	0	QUANT	0.0024	4.7700e+000	M	0.0e+000	Y	Y
95	911.07	Ac-228	100	QUANT	0.2770	6.1300e+000	H	4.0e-009	Y	Y
96	926.00	Pa-234	99	QUANT	0.1122	6.7000e+000	H	3.0e-006	Y	Y
97	926.18	Pa-234m	102	QUANT	0.0037	1.1700e+000	M	0.0e+000	Y	Y
98	934.06	Bi-214	103	QUANT	0.0321	1.9900e+001	M	3.0e-007	Y	Y
99	946.00	Pa-234	105	QUANT	0.1224	6.7000e+000	H	3.0e-006	Y	Y
100	964.60	Ac-228	101	QUANT	0.0521	6.1300e+000	H	4.0e-009	Y	Y
101	969.11	Ac-228	45	QUANT	0.1662	6.1300e+000	H	4.0e-009	Y	Y
102	1001.00	Pa-234m	97	QUANT	0.0059	1.1700e+000	M	0.0e+000	Y	Y
103	1120.30	Bi-214	104	QUANT	0.1515	1.9900e+001	M	3.0e-007	Y	Y
104	1238.10	Bi-214	107	QUANT	0.0594	1.9900e+001	M	3.0e-007	Y	Y
105	1240.50	Pa-234	30	QUANT	0.0051	6.7000e+000	H	3.0e-006	Y	Y
106	1310.00	Tl-210	58	QUANT	0.2078	1.3000e+000	M	0.0e+000	Y	Y
107	1377.70	Bi-214	109	QUANT	0.0411	1.9900e+001	M	3.0e-007	Y	Y
108	1460.80	K-40	0	QUANT	0.1067	1.2770e+009	Y	2.0e-007	Y	Y
109	1764.50	Bi-214	79	QUANT	0.1584	1.9900e+001	M	3.0e-007	Y	Y